



NGSSA NEWS

May 2017 ❖❖❖ Issue 15



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NGSSA's biggest event of the year!

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Free games free dinners and free fun Hurray!!!

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Creating societal impact through research: motivations and opportunities

To our dear readers

It has been another semester, and we hope everyone is doing great. In this issue, we recap all the exciting events of the past few months and continue to share our food for thought in the featured column on research and communications. We hope you enjoy! Please also extend your warm welcome to the batch of January 2017 NGS students, to whom this issue is dedicated.

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About NGS Scholars' Alliance

An official student group of the NUS Graduate School for Integrative Sciences and Engineering (NGS).

Established in 2005 to serve as a platform for exchange, personal development, and leadership training for NGS scholars, as well as the key to fostering the NGS community and identity.

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The 9th NGS Annual Symposium T.i.D.E.S

In early AY 2016/2017, NGSSA decided that the 2017 symposium would revolve around emerging topics in a wide range of fields in science and engineering. However, since in Singapore there must be an acronym for every single imaginable thing, we were stuck with not being able to set the symposium theme to be Advanced Research in Science and Engineering. Luckily, the sun, the moon, and the earth formed a syzygy, and it suddenly hit us: thou shalt be named TiDES — Trends in Interdisciplinary Engineering and Sciences.

The symposium started off with a captivating keynote presentation by the Director of the Institute for Media Innovation, NTU, Prof Nadia Thalmann on Nadine, one of the most realistic social humanoid robots to date. Nadine is a polyglot, knows how to get angry, has a memory that is definitely better than some, if not most, of us, to name a few of her impressive features. Nadine exemplifies how the collaborative effort of robotic engineers, psychologists, and sociologists can transform boundaries.



Other highlights of the day include the presentations by session speakers Dr. Wan Yue, who brought us to the exciting world of research on functional RNA structures, and Mr. Fan Mingwei, who promoted the impact of inter-disciplinary research in 3D printing personalized medicine, and stem cells and regenerative medicine. The panel discussion on life after PhD, featured NGS alumni from all sectors—from consultancy and investment to academia, start-ups, and publishing—getting together to share about their PhD days, how they embarked on their current careers paths, and how the PhD experience helps with their career, has stirred massive audiences' response and interest.





An important aim of the symposium is to provide a platform for NGS students to interact and showcase their research. This year, TiDES attracted 26 oral submissions and 29 poster presenters, and welcomed around 150 NGS student participants. Presenting his research on flexible microfluidics in disease sensing and rehabilitation monitoring, and artificial sensing, Yeo Joo Chuan has won the Best Oral Presenter prize. The best poster prizes went to Er Jun Zhi, Cheryl Chan, Jocelyn Teo, and Joanne Ku from the Life Sciences, Sheldon Ho, Wang Ming and Ho Yan Teck from Engineering, and Sherman Tan from Chemistry. Congratulations to the prize winners and See you all again at the next symposium!!! ■

“The highlight of every academic year in the NGSSA is the NGS student symposium. A year’s worth of preparation by the committee is distilled into a day of talks and presentations from a variety of disciplines. This year’s symposium TIDES evoked vivid imagery of a tidal front – representing the up and coming forefront of research in various disciplines, and the movements of the tides signifying the progress and development of us as scientists in each of our own fields of research. We, the NGSSA committee, hope that the participants and speakers enjoyed the symposium and that we inspired students in the NGS program to step up and play a role in NGSSA committee and in the organizing of the next year’s symposium.”

— Alvin Ng, NGS 9th Symposium Co-chair

NGS Bonding Events

The NGS building is situated at a nice location up on the slope leading to the NUS KRC forest area, which offers superb serenity and biodiversity for a cool break at work. However, when it comes to NGS bonding events, the location can be one of the impediments—getting there is literally an uphill battle, with an additional pre-battle sardine canning process on the shuttle bus or train for those in Engr/SoC/FASS/RIs—there is no denying that the Science/Med people have it much more easily.



Thus, instead of the usual “CeLS gathering”, our October’s Halloween event was moved to Orchard Road for a pinch of change. On a carnivalesque Saturday night, a “squad” of NGS students gathered at a corner of Grange Road to head to the Doll Museum at *Scape @ Orchard. The much awaited experience turned out to be short and sweet: it featured a tour to an insane doll maker’s factory, where human beings were slaughtered into toys, which all of us either actually believed or we gathered the remnants of our courage to pretend that it hardly scared anyone. That said, we all agree that it was fun and that we should continue the fun by heading straight away to a game of skill house nearby. Thanks to the conducive environment there, we got to know one another better while enjoying jenga, uno, tumblin’ monkeys,... you name it. The Halloween event ended with us strolling

under the bright street light of the ever crowded shopping areas before parting our ways.



Festivities are the perennial theme of NGS events, and so on December 16, 2017, we held a party at CeLS lobby to celebrate the grand festive season. The event started off on a cosy note as the participants used a bunch of toilet paper to break the ice. Each of us were asked to take some sheets of toilet paper for unknown reasons. Some took one to save trees. Some took two as it is their favorite number. Some secretly decided to take a lot so that they could fold a thick paper shield to cover the colossal word “shy” written on their face, just to find out later that each sheet of paper equals one interesting fact they need to share about themselves. We then proceeded to a session of questions and answers on personal hobbies filled with hilarity, had some very good food, exchanged some very good gifts, and competed in intense board games of both physical and intellectual skills. ■



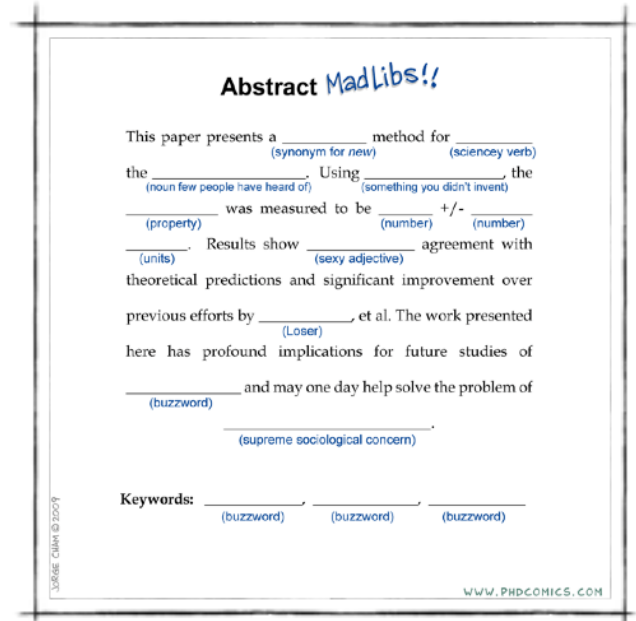
Papers, please.

Have you ever felt that your written sentences run too long, adding new important ideas and jargon after each consecutive comma, but ultimately the result seems to you like just various concepts strung together in an unbroken stream of consciousness, such that you aren't quite sure what the sentence was about when you got to the end? Has anyone ever told you that your prose is too verbose, too wordy, too repetitive, or too repetitive? Feel as if your writing is bland or not interesting to read? Don't worry, you are not alone. Whilst there is no substitute for practice, here are a few practical pointers and considerations to improve your paper writing.

Publish or perish. That is the reality for any PhD student. So, when you hit that submit button on the paper submission site, like Eminem's Lose Yourself, you only have one opportunity, one shot, to impress your reviewers or readers. This one chance is the trifecta of your title, your abstract, and your introduction. Your readers want to know, "Why should I read the rest of the paper, instead of throwing it away right now?" and "What are your contributions?"

A common mistake is to write your contributions as a chronological list of what you did, or your methodology. This makes it difficult for the reader to understand the novelty of your work. Instead, you need to describe explicitly how your paper:

- Makes improvements to the knowledge or methods of science/engineering/<insert-your-field-here>, and/or
- The areas in which your work is better than existing work.



"Piled Higher and Deeper" by Jorge Cham
www.phdcomics.com

For example, maybe your theory fits the data better, predicts behaviour more accurately, or maybe it provides a good overview of a field currently un-surveyed. In this way, you can properly place your paper in the context of the field you are contributing to. Don't be afraid to add the human story or motivation of this context. But before you even get to your contributions, the first thing your readers will see is your title.

A paper's title exists to catch the attention of the reader, and sets your paper apart. It creates expectations about the scope and purpose of a paper. Here you can stretch your creative muscles, if you have any relevant puns, quotes, or acronyms... Now is your chance. Remember, a good title needs to be catchy, concise, unique, and honest. But be careful to not exaggerate or undersell your work!

This next paragraph will completely change your life using one weird trick, so strap in and hold on. The general idea in these first critical

parts of your paper is to anticipate your readers thinking, and guide them through your work. Your words create expectations in the reader's mind, if you fulfil those expectations your reader is happy. If you don't fulfil them, it can leave your reader feeling frustrated. For example, at the start of this paragraph I promised you it would completely change your life. In reality, it has only improved your life by a measly (but publishable) 0.03%. Somewhat anticlimactic, no? In your writing, check these expectations, by making sure your sentences lead into each other. Making sure that questions that are raised, are addressed or considered swiftly.

On that note, sentences can come in all shapes and sizes. Some are short and quick, whilst others are long and unwieldy and perhaps outstay their welcome. Some florid or flowery language (used sparingly) can add some nice flavour to your writing. That said, there is no one correct way to write a paper, but here are few more general tips:

1. Use consistent phrasing throughout your paper.
2. Don't use synonyms as these may confuse your reader!
3. Limit the use of passive voice.
4. Set research or experimental goals in your paper, and then fulfil them. This reinforces the idea of progress in your work.

Finally, a conclusion needs to restate the contribution of the paper, with a particular emphasis on what it allows others to do. It should also propose new research directions to reduce duplication of effort or to encourage collaboration. It shouldn't introduce new ideas like this conclusion does. In fact, don't use this as an example! These small tips should hopefully point you in the direction of making your writing more interesting and clear to read. Unfortunately, there is no substitute for practice of course. Good and interesting writing is hard work! ■

N.B: This article is based on a seminar talk series "Power Papers" by NUS's own Associate Professor Terence Sim. If you get a chance, go see it! (<https://www.comp.nus.edu.sg/~tsim/>)

Research matters

While conducting experiments, have you ever wondered if your research is going to be important for someone outside academia? Very often, the possibility of seeing a tangible real-world application of your efforts can be a good source of motivation. While everyone agrees that investing in scientific research creates a more robust framework for economic growth in a society, it is difficult to assign a value to the societal benefits generated.

The first attempt to understand the economic value created by academic research was published by Edwin Mansfield. By looking at different industries and how they benefitted from academic work that was published in a related field [1], he concluded that spending on academic research led to an average return of 28%. About 10% of the products that were launched in a year (at that time) could make use of the literature that was published in a related field. That's interesting because the transformative effects of academic research on our lives can be overlooked quite often. The evolution of the internet exemplifies this. Tim Berner Lee envisaged the world wide web as a tool for academic collaboration. Something that was only meant to help scientists within a lab became the most important communication medium in the world. Similarly, Google began as a doctoral project before becoming arguably the most important internet company. The ubiquitous LCD screen is a highly-refined version of an early prototype invented by James Ferguson in 1960. Lithium ion batteries, which are used in all computing devices today, emerged from the Materials science labs at MIT. In 1938, two graduate students at the University of Toronto built the world's first

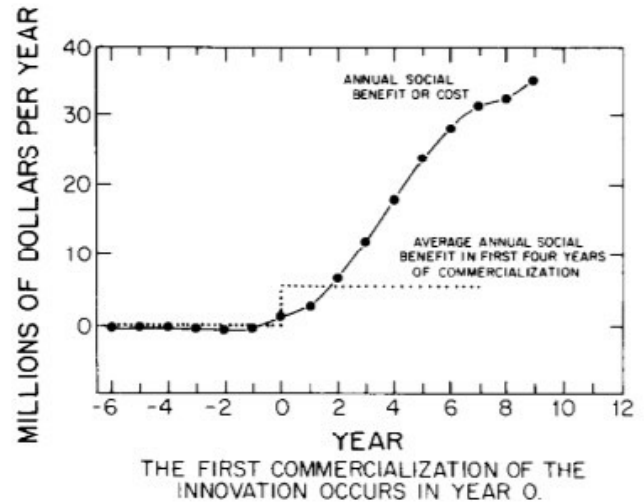


Figure 1. Annual social benefit or cost by year, from first commercialization of innovation.

Source: Mansfield, Edwin. "Academic Research And Industrial Innovation". *Research Policy* 20.1 (1991): 1-12.

electron microscope, which opened the sub-wavelength world for scientists to explore.

Similar examples can be cited for medical products as well. Insulin was discovered by Dr Frederick Banting and his colleagues at the University of Toronto. By the early part of the nineteenth century, it was known that pancreatic secretions regulated blood glucose levels. By conducting experiments involving isolation and injection of pancreatic secretions in dogs, they discovered a solution that has saved millions of lives. Technologies for medical diagnostics, such as the MRI or CT Scan equipment, were developed in university laboratories. In fact, the phenomenon of quantization of electron energy levels (proposed by Niels Bohr) in 1913 was critical to the development of X-Ray and MRI scanning equipment, although no one could have foreseen it at the time.

It's also interesting to note that most practical inventions were nurtured by diversity and knowledge transfer across the boundaries of different disciplines. While expertise in isolated disciplines is important, cross disciplinary exchanges are usually more productive.

Why is this something that we should think about? Well, there are moments when we might have to choose between experiments that, if successful, could lead to a tangible improvement in an existing process, and experiments that would contribute to fundamental knowledge, that may be helpful for an inventor in the future. However, the practical manifestation could take decades. To decide what's more suitable, it is good to think about your motivation while starting PhD. Working with an existing process to make it better might be good for someone who likes to see research being industrially relevant. Fundamental research that can fructify into an useful invention over a much longer time-frame is likely to interest those with a passion for a specific field.

Without changing the course of research, there are other ways to make your PhD journey more connected to the world outside the lab. One option could be to participate in projects that have an industrial partner. This may not be relevant for all fields, but it can teach us quite a bit about scalability challenges when a process is transferred from a lab to a much larger mass-production set up. In fact, it offers a chance to

understand the industry and identify post-PhD employment opportunities. However, finding a project involving an industry is not easy, and very often, there are restrictions on the dissemination of the research data in the form of publications/conference proceedings. Unless one is allowed to publish, participating in such a project may not represent a productive use of your PhD time.

Another opportunity to link research to a practical application could be to intern part-time in a company that makes use of knowledge from a related field. Without receiving any monetary benefit from the company, one could try to work remotely to understand the industry better. Budding start-ups are usually always looking for expert input, and contacting them can lead to an internship that doesn't distract you from your PhD but still serves as a good learning platform.

Modules offered by the Institute for Engineering Leadership (IEL) can be a great way to learn how technologies are transformed into marketable products. Although you might get to work on a technology that is not related to your thesis topic during the semester, the framework that's taught is universally applicable.

TL;DR: You have many opportunities to take your research out of the lab and use it to solve, or help to solve, a practical problem. Doing so could motivate you, help someone and make the world a slightly better place. ■

Reference

1. Mansfield, Edwin. "Academic Research And Industrial Innovation". *Research Policy* 20.1 (1991): 1-12.